Asian Journal of Applied Science and Technology (AJAST)
Volume 7, Issue 2, Pages 151-170, April-June 2023

Assessment of Nutritional Status of MBChB 4th Year Second Semester Students at Cavendish University Zambia, Longacres Campus, Lusaka, Zambia

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DOI: https://doi.org/10.38177/ajast.2023.7217

Article Received: 09 April 2023 *Article Accepted: 22 May 2023* *Article Published: 31 May 2023*

ABSTRACT

It has been established that leading a sedentary lifestyle makes people prone to health problems such as hypertension, diabetes and poor nutrition. In addition, the poor sanitary conditions in schools and places of lodging have resulted in the contraction of urinary tract infections. The main aim of this study was to determine the general health status of the 4th year medical students at Cavendish University Zambia, Lusaka. This was done through the analysis of blood sugar levels, urine samples, blood pressure and body mass index. The study serves to answer what the nutritional status is based on body mass index, how blood pressure relates to hypertension, what the levels of diabetes are among students, what the general urinalysis findings are and the general factors associated with the health status of students.

The study was conducted on 41 students, 26 being males and 15 females. In the blood glucose test, 14% presented with an abnormal level of glucose and 86% were normal. On average male students had a blood glucose level greater than 6.0mmol/L while female students had levels below 6.0mmol/L. in the BMI calculations, 61.3% of the students had a normal BMI, 7 being female and 20 being male a total of 8 females and 6 males had an abnormal BMI value. The criteria for normal urinalysis value were the absence or traces of the substance and abnormal values were indicated by the presence of small, moderate or large amounts of the substances. 100% of the students had normal glucose, blood and urobilinogen readings. 55.4% of the participants presented with normal blood pressure while 44.6% presented with abnormal blood pressure levels.

Keywords: Cavendish University Zambia; Health problems; Nutrition; Hypertension; Blood glucose level; Urobilinogen.

1. Introduction

The statement "*prevention is better than cure*" has been attributed to Dutch philosopher Desiderius Erasmus in around 1500 and to date it is a fundamental principle in maintaining and preventing ill health worldwide [1]. This practice has since increased the life expectancy of individuals all around the world. However, it has been reported that the enrolment of students in medical school has made it difficult for them to maintain healthy behaviours over the course of their studies due to the time, demands and challenges that the course requires [2].

Lack of exercise, poor eating habits and poor sleeping habits due to work overload and many others have been/are the norm among medical students. With the author being a 4th year MBChB student who has experienced the above-mentioned and has received inputs from colleagues and several articles [2], it has been proven that those habits take a negative toll on their health and eventually on their studies. For instance, in the short term, the above-mentioned can contribute to stress, tiredness, and reduce the levels of concentration hindering their capacity to work effectively. Some students become underweight whereas others tend to gain unhealthy weight/obese which can increase their chances of getting serious health conditions such as getting sick frequently, feeling tired all the time, coronary heart disease, stroke, high blood pressure, type 2 diabetes and many others or even cause death.

This research was conducted at Cavendish University Zambia, school of medicine particularly on MBChB year 4 students. The university has two intakes yearly (January and July) and runs different programmes such as Nursing (5 years), Clinical Medicine (5 years) and the Bachelor of Medicine and Bachelor of Surgery (MBChB) (7 years), the first year being a Medical School Foundation Programme (MSFP). The first 4 MBChB years are theory and the last 3 years are clinical.

This research focuses on 4th year MBChB students and the parameters that were taken into consideration were Body Mass Index (BMI), Blood Pressure (BP), glucose levels and urinalysis. Please take note that the findings in this report are not the diagnosis but are key factors to look at when making a diagnosis. The overall goal of this research is to improve and/or maintain the health status among the medical students at Cavendish University Zambia through educational purposes and medical attention if need be.

2. Objectives

2.1. General objectives

To find the general health state of the 4th year medical students' class at Cavendish University Zambia in Lusaka.

2.2. Specific objectives

1. To assess the nutritional status of the medical students using the Body to Mass Index (BMI).
2. To examine the glucose concentration in the blood among the students.
3. To analyze the urine contents using urinalysis.
4. To determine the association between sex and blood glucose.
5. To evaluate the relationship between sex and BMI.

3. Research Questions

1. What is the nutritional status of MBChB 4th year second-semester students at the Cavendish University based on Body mass index (BMI)?
2. How does blood pressure relate to hypertension among these students?
3. What are the levels of blood glucose among students?
4. What are the general urinalysis findings among the students?

4. Literature Review

According to WHO (2016), non-communicable diseases such as hypertension, diabetes and obesity contribute to about 29% of deaths in Zambia each year. This is by far an unacceptably high percentage considering that most of these diseases can be reduced by mainly modifying some of the behavioural risk factors for NCDs such as reduction in tobacco use, controlling harmful use of alcohol, increasing physical activity and avoiding unhealthy diets and high stress levels. The burden of non-communicable diseases in Zambia keeps on increasing with each year, with significant consequences on morbidity and mortality levels not only to the general public but also within the medical sector among medical students as well as medical practitioners (Wagner and Brath, 2012). One of the methods that has been employed by the Government of Zambia through the Ministry of Health to reduce this rising burden on the morbidity and mortality rate are screening tests for these NCDs. By definition, screening is a strategy that is used to look for diseases in apparently healthy individuals who are at a high risk of developing a particular health disease (Hall and Harriet, 2019). The government employed this method for early detection of diseases when they are still easier to treat thus reducing the morbidity and mortality levels caused by these NCDs. This Literature

review looks at some of the local and global literature published to evaluate the prevalence statistics around these diseases, their risk factors and any other information relevant to this study.

4.1. Lifestyle of medical students and how it affects their health status

Medical school is a challenging period that can bring about undesired changes in health and lifestyle habits. Scientific evidence confirms that unhealthy life habits play a role in the development of many disorders in all age groups. Medical students often have many courses that they are taking and thus more hours of lectures per week without extracurricular activities. The lack of extracurricular activities seen among medical students leads to an increase in physical inactivity which in the long run affects their health. The high frequency in tests and assignments as well as other activities like lab work and hospital work take up most of their time leaving them with little to no time for recreational purposes and no time to look after their own health. Medical students are often stretched out thin during the twenty hours of the day getting minimum hours of sleep.

All of the factors above greatly contribute to some of the unhealthy lifestyle choices that students make in order to cope with the stress that medical school brings. Our goal is to assess how these lifestyle habits relate to the prevalence of these diseases that are being screened for.

Table 1. Unhealthy lifestyles and their impacts on the health of medical students.

Unhealthy lifestyle	**Impacts on health**
Lack of sleep	Leads to anxiety and depression. When an individual experiences depression and anxiety their heart rate and blood pressure rise (Nutt et al., 2008).
Elevated stress levels	When an individual is stressed, their body produces a surge of hormones and these hormones temporarily increase your blood pressure by causing your heart to beat faster and your blood vessels to narrow (Dahlin et al., 2005).
Physical inactivity	If you are not active enough, you do not use the energy provided by the food you eat, and the extra energy you consume is stored by the body as fat and this over time can lead to obesity (Owen et al., 2020).
Drug and Alcohol abuse	Long-term abuse of drugs and alcohol can directly damage the kidney, bladder, and other components of the urinary tract. These damages can lead to severe and potentially fatal consequences (PubMed Health, 2012).
Unhealthy diet	Highly processed foods that are high in calories and low in vitamins, minerals, and fibre break down quickly in the body and can cause a rapid rise in blood sugar levels (Schuster, D., 2008).

The table above summarises some of the unhealthy lifestyle behaviours that are seen in medical students and how these are risk factors to the NCDs in this study. Other behaviours include lack of self-care and tobacco use.

4.2. Prevalence of conditions of interest in the population of Zambia

To determine the prevalence of and risk factors for diabetes, hypertension and obesity the Zambian Government through the Ministry of Health has conducted various tests throughout Zambia. This has helped to find the most

affected individuals and those at a higher risk of developing the diseases mentioned above thus ensuring good health within the Zambian population.

4.2.1. Diabetes

The Zambia diabetes prevalence was recorded to be 11.9% by year-end 2021 and has fluctuated substantially in recent years, it tended to increase through the 2010 - 2021 period ending at 11.9 % in 2021 (Lopez et al 2021). In a survey that was conducted by the WHO in 2016 to determine among other objectives the prevalence of diabetes in Zambia the impaired glucose level or diabetes was recorded to be 4.2% from individuals between the age of 30 to 70. This survey was conducted in Lusaka district, Zambia and 1928 individuals participated in the survey (WHO, 2016). In another study that was conducted the results showed that Zambia experiences a lot of cases of diabetes mellitus however, the diabetes prevalence of Zambia is 5.13 % of population ages ranging from 20 to 79 and with a global ranking of 153 (Mecometer 2013). The population affected in this last study shows that a large number of students are also affected by diabetes and this includes the medical students as well.

4.2.2. Obesity

Amongst the population of the 1928 individuals 4.2% of the participants (5.1% of males, and 18.6% of females) were obese. Male participants were 55% less likely to be obese compared to female participants. Compared to participants who attained college or university level of education or students in general were 63% more likely to be obese (Pubmed 2016). In another survey that was conducted in the southern region of Africa, A total of 989 third-year medical students (527 men, 462 women), aged 22 ± 2 years, were recruited from the University of Crete during the period 1989–2001. Anthropometric measures BMI (body mass index, waist circumference [WC], waist-to-hip ratio [WHpR], waist-to-height ratio [WHtR]). Approximately 40% of men and 23% of women had BMI ≥ 25.0 kg/m2. Central obesity was found in 33.4% (average percentage corresponding to WC ≥ 90 cm, WHpR ≥ 0.9 and WHtR ≥ 50.0) of male and 21.7% (using WC ≥ 80 cm, WHpR ≥ 0.8, WHtR ≥ 50.0) of female students (Public health, 2003).

4.2.3. Hypertension

Prevalence of hypertension is reported to reach 34% in some areas of Zambia but public awareness is reportedly low, an opportunistic cross-sectional survey of volunteers aged ≥18 was carried out in May 2017. A total of 9607 individuals were screened during MMM17. After multiple imputation, 2438 (25.9%) had hypertension. Of individuals not receiving anti-hypertensive medication, 1706 (19.6%) were hypertensive. Of individuals receiving anti-hypertensive medication, 438 (62%) had uncontrolled BP. The MMM for 2017 was the largest BP screening campaign undertaken in Zambia (Franco, Peeters, Bonneux and Laet, 2005).

4.2.4. Urinalysis

Urine tests can help detect diseases of the urinary system as well as metabolic diseases like diabetes or liver disease. The color, odour and amount of urine can already indicate whether something is wrong. If, for instance, someone passes only a little very dark urine, it could be a sign that they have not had enough to drink or that their kidneys are no longer working properly (Pahira JJ (March 2005). Cloudy or flaky urine could be a sign of a urinary tract infection. If the urine is reddish in color, there might be blood in it. To find out more, the urine needs to be tested

using a test strip or in a lab. Five standard urine tests can be used to examine the different components of urine. Two of them can also be done at home, whereas the other three can only be done in a lab.

4.3. Screening tests and their importance

It is important for medical students to carry out the Screening tests because screening tests are a cost-effective means for identifying subjects with early stage (and thus potentially more treatable) disease before symptoms develop and therefore, saving lives. In screening, it is important to note the sensitivity of the test which is the ability of the test to reflect the probability that the screening test will be positive among those who are diseased (Harriet H, 2019). In contrast, the specificity of the test reflects the probability that the screening test will be negative among those who do not have the disease (Wagner K, 2012). Thus, will help the researcher to determine the effectiveness of the screening tests. In addition, some of the importance of carrying out early screening tests to medical students is to prevent or to cure a disease before the disease has started manifesting its symptoms.

In this study some of the diseases that the researchers screened are as follows; urinary tract infections, kidney failure, diabetes, obesity and blood pressure. The screening tests will help medical students to be stress-free as results of focusing on their studies.

5. Statement of the Problem/Rationale/Justification

5.1. Statement of the problem

The overwhelming workload those medical students are subjected to has led to them having a sedentary lifestyle in which they spend most of their time studying and seated in classes for hours attending lectures. This has resulted in an increase in stress levels, and bad eating habits of fast foods due to lack of time to prepare a healthy balanced meal. This sedentary lifestyle makes the students prone to conditions such as hypertension. Furthermore, bad eating habits have made students susceptible to conditions of malnutrition, that is being overweight (obese) or underweight (severely malnourished). Poor sanitation circumstances, such as filthy toilets that may be encountered by students at school, home or in boarding houses may cause urinary tract infections, hence urinalysis was performed to determine if the student's populace has urinary tract infections.

5.2. Justification

Through this study, medical students of Cavendish University will be able to know their nutritional status and thus, have a better understanding of the importance of maintaining a balanced and healthy diet. This will help them seek better health eating habits and a change in lifestyle to improve their health. This change would be exercising regularly, maintaining a recommended salt and sugar intake to mention but a few. The findings will urge the school management to provide adequate sanitary facilities that will enable the cleaners to keep the environment clean and tidy in order to combat the challenges of urinary tract infections. The school management can use this information to improve student's extra-curricular programs such as sports. Due to little or no research done on sanitation and hygienic practices among students in their boarding houses, the researcher is interested in filling the gap by assessing the state of sanitary facilities in their boarding houses and hygiene practices among students at Cavendish University. This study may serve as part of the necessary literature review for future researchers in higher learning institutions undertaking similar studies.

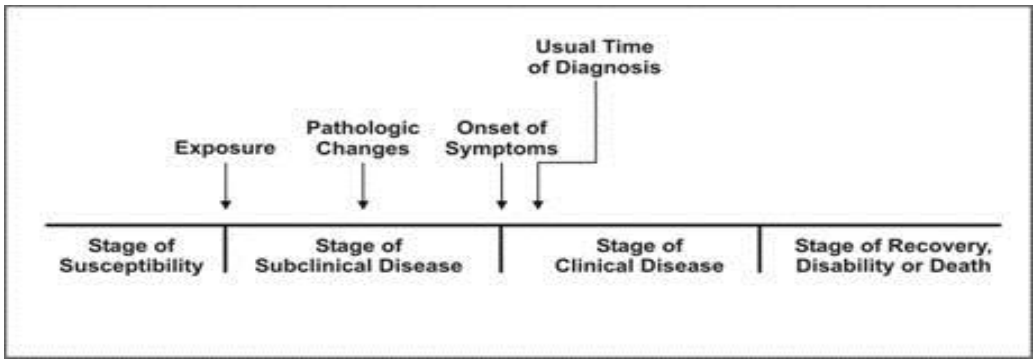
6. Conceptual Framework

6.1. Natural History of Disease and Screening

In this study, the natural history of disease and screening was used as the theoretical framework to guide why we are screening for disease in fourth-year students at Cavendish University Zambia, Lusaka.

Natural history of disease refers to the progression of a disease process in an individual over time, without treatment whereas sscreening may be defined as "The presumptive identification of unrecognised diseases or defect by the application of tests, examinations or other procedures which can be applied rapidly to sort out apparently well persons who probably have a disease from those who probably do not." The screening test itself does not necessarily diagnose illness, those who test positive are evaluated by a subsequent diagnostic procedure to determine whether they in fact do or do not have the disease.

Table 2. A model for natural history of diseases



The period from exposure to the time before symptoms is the screening time, this is therefore the first possible point after disease onset to the final critical diagnosis.

After the disease process has been triggered, pathological changes then occur without the individual being aware of them. This stage of subclinical disease, extending from the time of exposure to onset of disease symptoms, is usually called the **incubation period** for infectious diseases, and the **latency period** for chronic diseases.

During this stage, disease is said to be asymptomatic or inapparent (Wilson & Jungner, 1968). The timeline shows state of susceptibility, exposure, subclinical disease in which pathological changes takes place, onset of symptoms, followed by usual time of diagnosis, clinical disease, followed by recovery, disability or death.

6.2. The aim of early disease screening

The aim of early disease detection (sometimes called secondary prevention) is simple. Primary prevention seeks to abolish disease by protecting the individual and the population from attack before the challenge has been made. Early detection aims at discovering and curing conditions that have already produced pathological change but which have not so far reached a stage at which medical aid is sought spontaneously (Wilson & Jungner, 1968).

6.3. The importance of screening

A screening test is done to detect potential health disorders or diseases in people who do not have any symptoms of the disease. The goal is early detection and lifestyle changes or surveillance, to reduce the risk of disease, or to detect it early enough to treat it most effectively.

6.4. When is a screening test helpful?

What makes a screening test valuable is its ability to detect potential problems, while minimizing unclear, ambiguous, or confusing results. While screening tests are not hundred percent accurate in all cases, it is generally more valuable to have the screening tests at the appropriate times. It is valuable to carry out the screening at the duration from exposure to the time before symptoms.

6.5. Conditions that were screened for as part of the study

6.5.1. Blood pressure screening

A blood pressure test measures the pressure in arteries as the heart pumps. A person might have a blood pressure test as a part of a routine doctor's appointment or as a screening for high blood pressure (hypertension). Some people use a blood pressure test at home to better track their heart health.

6.5.2. Diabetes screening

Diabetes is usually tested by using a blood glucose test. Normally, a blood sample is taken from a vein and sent to a pathology lab for analysis. There are different types of blood tests. It may be recommended to fast overnight beforehand (fasting blood glucose test) or not need to prepare

6.5.3. Urinalysis screening

A urinalysis is a test of urine. It's used to detect and manage a wide range of disorders, such as urinary tract infections, kidney disease and diabetes. A urinalysis involves checking the appearance, concentration and content of urine.

6.5.4. Body mass index screening

Body mass index (BMI) is a measure of body fat based on height and weight that applies to adult men and women, BMI Categories.

7. Methodology

7.1. Introduction

This section gives an outline of the research methods that were followed in the study. It provides information on the participants, that is, the criteria for inclusion in the study, who the participants were and how they were sampled. The researcher describes the research design that was chosen for the purpose of this study. The instruments that were used for data collection are also described and the procedures that were followed to carry out this study are included. The researcher also discusses the methods used to analyze the data.

7.2. Study design

Quantitative cross-sectional study.

7.3. Study setting

The study was carried out at Cavendish university school of medicine at long acres Zambia.

7.4. Study population

Fourth-year second-semester medical students.

7.4.1. Sampling size and recruitment

All the participants in the fourth year second semester class (Census);

n=41 participants;

Sampling was done using 95% confidence interval and 5% margin of error.

7.5. Inclusion criteria

- All the participants were present on the day.

7.6. Exclusion criteria

- Sick participants.
- Pregnant participants.

7.7 Data collection procedures

7.7.1. Blood Pressure Measurement

The patient's bladder was emptied before the reading so as to not affect the results. The patient sat on a comfortable chair with their back supported for at least 5 minutes before the blood pressure measuring commenced. Both feet were flat on the ground and legs kept uncrossed. The arm was rested with the cuff on a table at chest height. The length of the bladder arm was at least 80% arm circumference. No talking was done during the measurement. The blood pressure cuff was made sure not to be too tight. The cuff was against the bare skin, not over clothing. The pulse obliteration pressure was determined by palpation of the radial artery.

The pressure of about 30mmHg was added to the already inflated cuff before slowly deflating the cuff by 2mmHg every second with a stethoscope head place on the medial brachial tendon for taking note of the first korotkoff sound which was the systolic pressure as viewed on the pressure gauge. First the auscultatory gap was taken down at the point at which the korotkoff sound disappeared, which was the diastolic pressure. Both the systolic and diastolic pressure was recorded as systolic pressure/ diastolic pressure measured in mmHg. A list of the tools used are found in the appendix.

7.7.2. Blood sugar measurements

The research participant's finger was then swabbed with alcohol. Using a lancing device, the skin on the side of the thumb was carefully punctured. The thumb was then gently pressed near the spot of penetration to squeeze more blood onto the test strip inserted into the glucometer. Promptly, the research participant was asked to press a small piece of cotton wool against the puncture hole on the thumb to stop the bleeding. The reading on the glucometer was shortly recorded. A list of the tools used are found in the appendix.

7.7.3. Urine Analysis

The procedure was explained to the patient in a culturally appropriate way and age-appropriate terms, after that, the patient's name and date of birth as indicated on the sample bottle and given to the client. Thereafter, hand hygiene

was conducted before and after client contact; Women were instructed to clean around the urethra by spreading the labia and wiping from front to back (toward the anus). Men needed to clean the tip of the penis and retract the foreskin.

After cleansing, they were asked to urinate for a few seconds to ensure that any contaminants in the urethra were cleared. Patients were asked to place their cup under the urine stream and collect at least 30 to 60 milliliters (roughly three to five tablespoons and Empty the rest of their bladder into the toilet.

The specimen was tested as soon as possible. The reagent bottle was inspected and ensured that the reagent had not expired. A strip was removed and the cap replaced, after that we inspected the strip for any signs of deterioration prior to use. Complete immersion of the end of the strip briefly into the freshly voided urine specimen was done and removed immediately and then the edge of the strip tapped against the edge of the specimen container. The strip was held in a horizontal position to prevent possible mixing of chemicals, and we noted for any color changes and results were recorded.

Using the color chat:

- glucose and bilirubin were read at 30 seconds;
- ketones were read at 30 seconds;
- specific gravity was read at 45 seconds;
- pH, proteins, urobilinogen, blood and nitrate were read at 60 seconds. 5. leukocytes were read at 2 minutes.

A list of the tools used are found in the appendix.

7.7.4. BMI procedure

The testing protocol was described to the client in an appropriate manner. Once consent was given, the participant's height was measured using a measuring tape. The participants had to remove their shoes and stand straight up with their heels against the wall. The height was recorded in meters. The client's weight was then measured using a scale. Beforehand the participant was asked to remove their shoes and wear minimal clothing. The client's weight was then recorded in kilograms.

The following formula was used to calculate BMI:

BMI = weight (kg) / height (m)2

BMI = _____ (kg) / [_____ (m) x _____ (m)]

Standardized cutoff points for underweight, normal, overweight and obesity: underweight is a BMI less than 18.0; Normal weight is a BMI between 18.5 and 24.9; overweight is a BMI between 25.0 and 29.9; obesity is a BMI of 30.0 or higher. A list of the tools used are found in the appendix.

7.8. Plan for data analysis

Data obtained from the study was entered into an excel spreadsheet and the data was analyzed and used excel to make bars and charts.

7.9. Ethical considerations

These ethical considerations were taken into account, according to the principles of autonomy, beneficence, confidentiality, consent and risks.

Autonomy- All the study participants were explained to clearly what the study was all about and given assurances that their identity would be kept confidential. Every participant made a personal decision to take part in the study and were not forced in anyway. A randomized selection system was done, which was aimed at keeping identities anonymous. Participants where requested to select random numbers and to each number, details about their age, sex, nutritional status and any other health concerns were filled in. Participants who were not comfortable withdrew from the study. It ensured that autonomy and freedom of choice was respected among participants.

Beneficence- This research was justifiable by its potential benefit, which include its contribution to knowledge and understanding, individual wellbeing, and to the skill and expertise of participants. Since each participant was required to do their own test and record results, this contributed to understanding the procedures and gaining skill of how to calculate BMI, check for blood glucose, measure blood pressure using two different BP machines and urine analysis.

To minimize the risks of harm or discomfort to participants; one of the participants offered to do the blood sugar test on other participants and also to reduce finger prick pain only the sides of the finger was pricked (thumb) where there's better blood flow, and not the pad of the finger.

Justice- A fair selection process was accomplished by not judging people on their ability to do the job not on the basis of one's race, color, sex, age, national origin, religion, disability. Investigators used fair and equitable recruitment practices in research and avoided practices that placed participants at risk for coercion or undue influence. The requirement for equitable selection was acquired from the ethical principle of justice. Prospective participants were not excluded simply because they are more susceptible to risk than others. Those who were already burdened (e.g., sick) were not asked to accept the burdens of research unless the research was relevant to their condition or circumstances. The selection process did not overprotect potential participants who were considered vulnerable so that they are denied opportunities to participate in research. Reasons related to the problem being studied. No one was exploited to participate or bribed to participate for it was a mandatory exercise for fourth year semester two Cavendish medical students.

Confidentiality- It is the researcher's responsibility to keep any information availed to them by the participant private. The researcher has tried to maximize the participant's confidentiality by not requiring to provide any information that may make it easy to identify the participant such as their full name or residential address. Also, the information provided by the participant will be kept in a locked file, and all electronic information will be coded and secured using a password-protected file.

Consent- Participants were given a detailed explanation before each procedure was done. Once the participant was adequately informed and verbal consent was given, the procedure was carried out.

Risk- There are no reasonably foreseeable (or expected) risks.

7.10. Study Limitations

There were observer bias as different individuals took turns to take the participants BP, BMI measurements.

Some data was misinterpreted especially when taking BP readings with a sphygmomanometer.

There was missing data from some participants upon entry.

The census was done on very small population and some of the expected participates did not show up for the study. This therefore changed the actual essence of the census as it was supposed to include everyone. This in turn means the results of the census were more of a probability than a fact.

8. Results

A total of 26 male and 15 female students participated in the blood glucose test. Of these students 14 % (of the 41 students) presented with an abnormal level of glucose in their blood (abnormal being <4mmol/L). 86% presented with normal blood glucose levels (normal being >4mmol/L) (Fig 1). The male students (26 males) showed a higher glucose level than that of female students (15 females). On average the male students had a blood glucose level >6.0 mmol/L whilst the female students had a blood glucose level <6.0mmol/L (Fig 2).

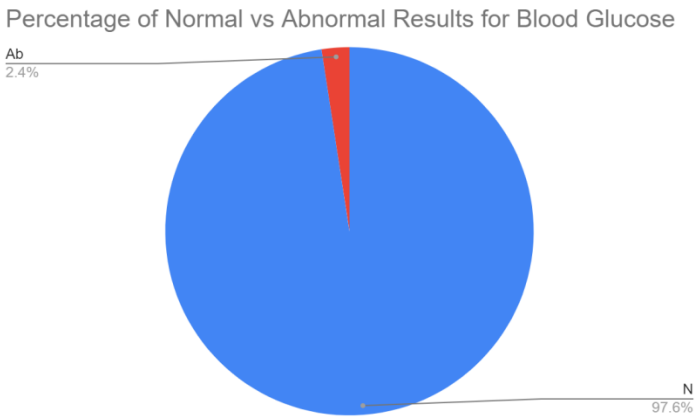


Figure 1. The percentages of total participants that had abnormal and normal blood glucose levels

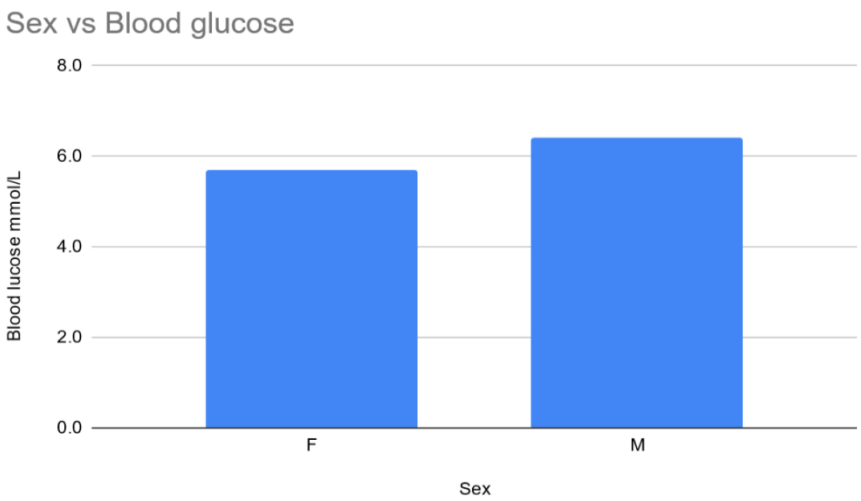


Figure 2. Average blood glucose levels of female vs male participants

A total of 41 students calculated their Body Mass Index. Of these students, 61.3% of them have a normal BMI, of which, 7 are female and 20 are male. 8 females had an abnormal BMI value (1 underweight and 7 overweight) and 6 males had abnormal BMI values (all overweight). More females than males were overweight.

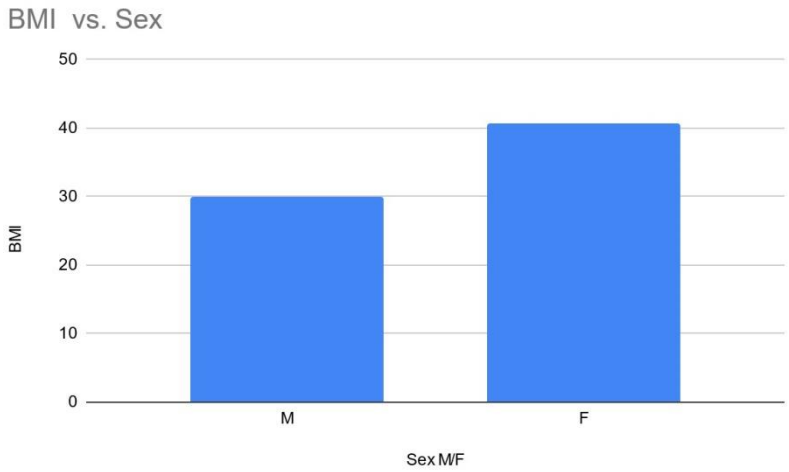


Figure 3. Chart of average BMI values between female and male participants

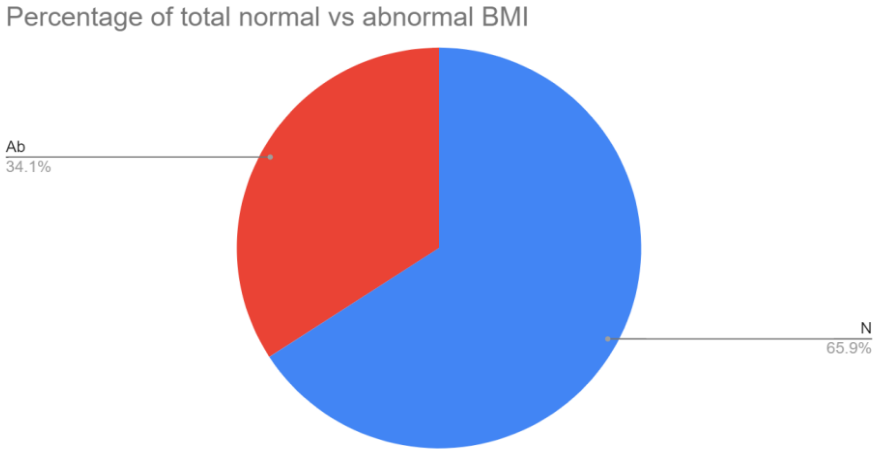


Figure 4. Percentages of total participants that had normal BMI values vs abnormal BMI values

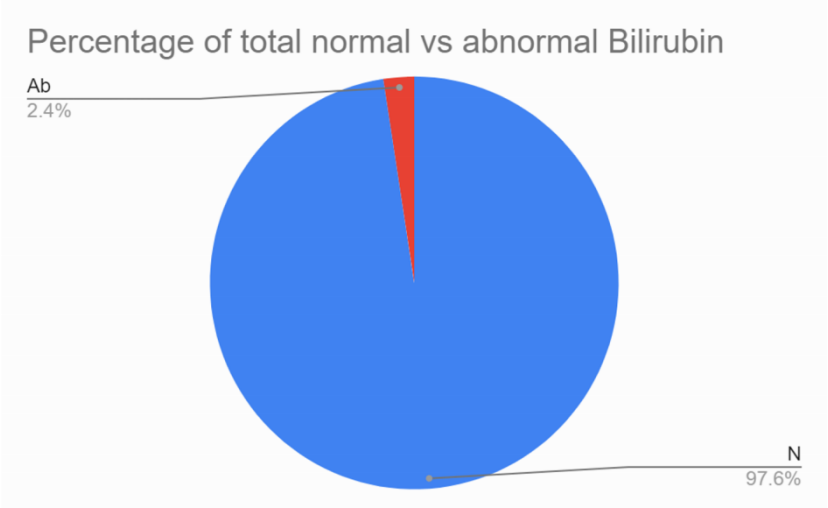


Figure 5. Percentages of total participants that had normal Bilirubin values vs abnormal Bilirubin values

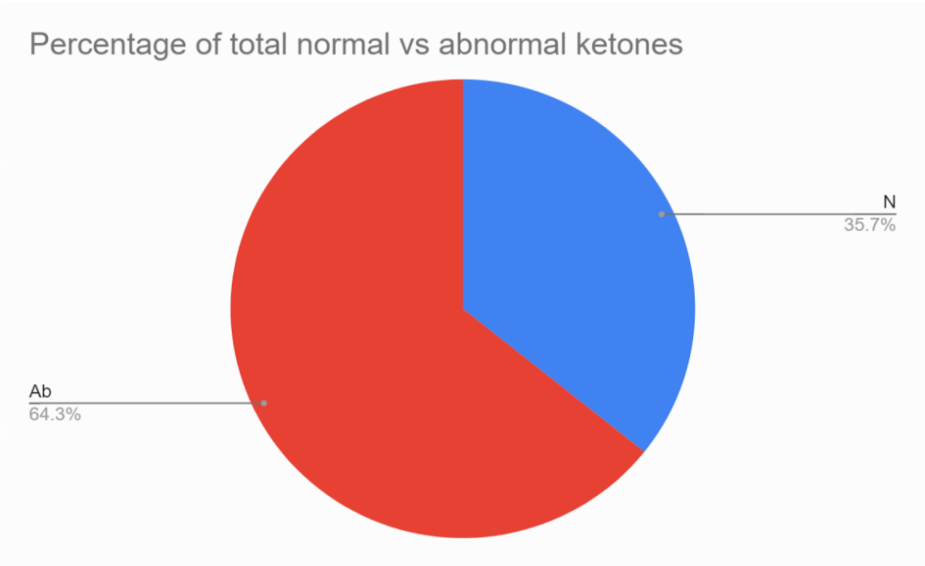


Figure 6. Percentages of total participants that had normal ketone values vs abnormal ketone values

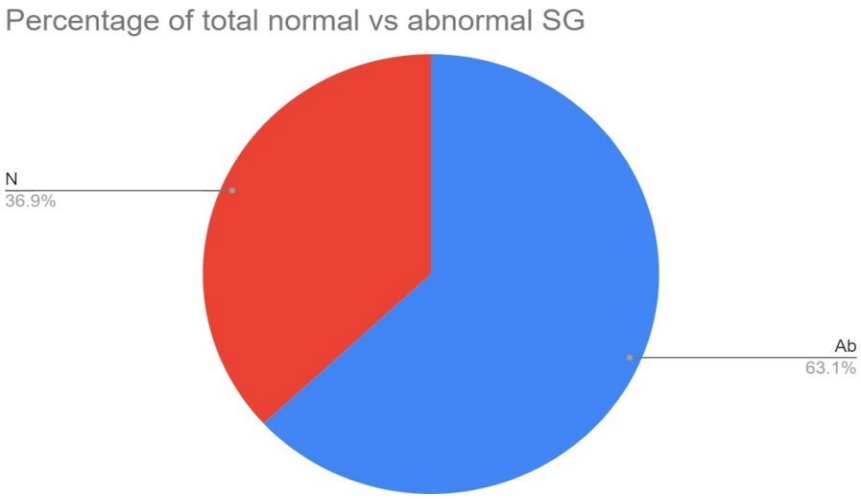


Figure 7. Percentages of total participants that had normal specific gravity values vs abnormal values

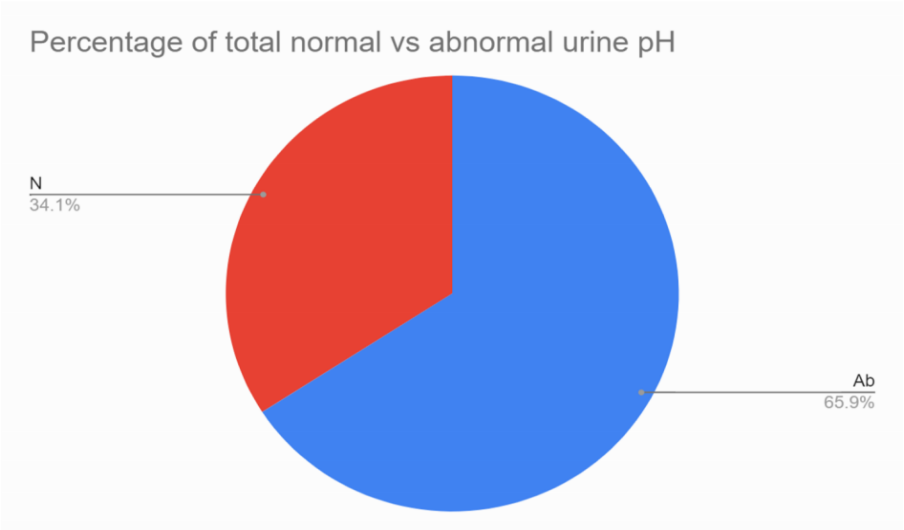


Figure 8. Percentages of total participants that had normal pH values vs abnormal values

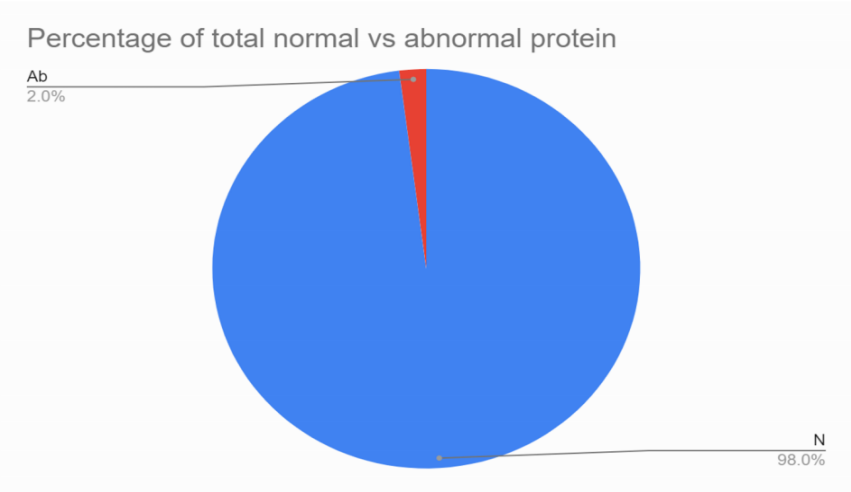


Figure 9. Percentages of total participants that had normal protein values vs abnormal values

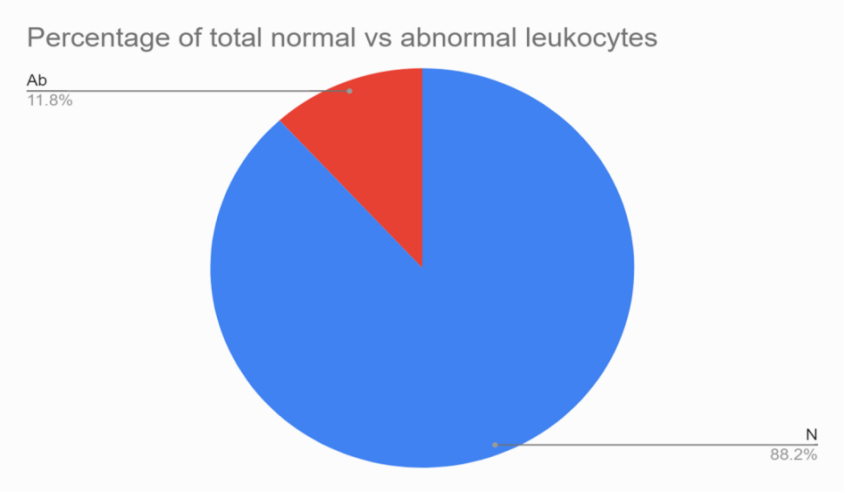


Figure 10. Percentages of total participants that had normal leukocytes values vs abnormal values

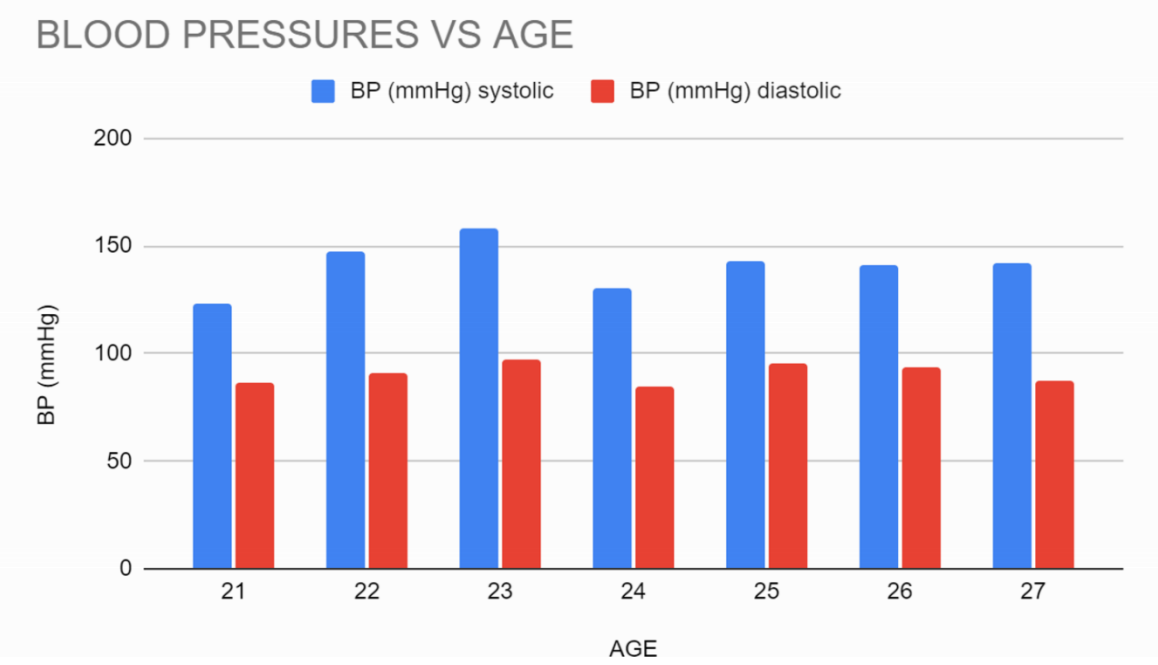


Figure 11. A graphical presentation of the systolic and diastolic blood pressure for specific age groups

Normal urinalysis values indicate no presence nor traces of the substance and abnormal values indicate a small, moderate or large amount of substance present.

100% of participants in the study had normal Glucose, absence of blood and Urobilinogen readings.

The Participants aged 23 presented with a very high blood pressure on average (Systolic pressure ±160mmHg, Diastolic pressure ± 95 mmHg) while those aged 22, 25, 26 and 27 presented with normal to moderately high blood pressure. The participants aged 21 and 24 presented with normal blood pressure values.

55.4% of the participants presented with normal blood pressure whereas 44.6% presented with abnormal blood pressure.

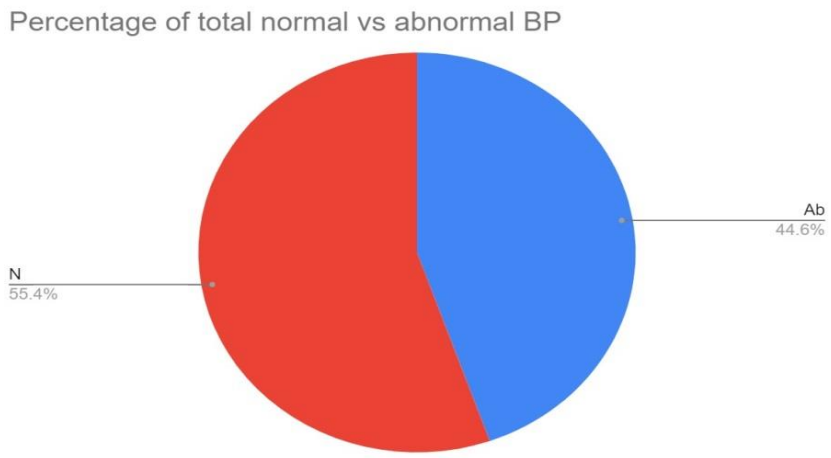


Figure 12. Percentages of total participants that had normal blood pressure values vs abnormal values

9. Discussions

9.1. Body Mass Index BMI)

In the research which was conducted by 4th year medical students at Cavendish University Zambia, the average BMI was found to be normal in ⅔ of the class and greater than 24.9 kg/m^2 in ⅓ of the class. From the results that were obtained during the screening exercises males had a lower BMI compared to females. In a similar study that was conducted it showed that males are more underweight as compared to females, which showed that females were more on the higher side of BMI in many cases (Satter A, 2013).

Generally, the factors which affect BMI are; family history, race, age, sex, eating and physical activity habits. (https://www.niddk.nih.gov/health-information/weight-management/adult-overweight-obesity/factors-affecting-weight-health).

Individuals with high BMI are likely to be overweight. This tends to reduce their activity and for students they are likely to get tired easily and fail to fulfill their targets.

9.2. Blood glucose levels

The blood glucose screening test reviewed that 86% of the individuals in class had normal glucose levels and 14% had abnormal glucose levels (hypoglycemic). In the normal physiological regulation of glucose the pancreas is a

key player by secreting the blood sugar lowering hormone, insulin and its counter opponent glucagon, during reduced glucose levels in blood, the pancreatic alpha cells secrete glucagon which converts glycogen to glucose while in instances of high glucose levels, the pancreatic beta cells secrete insulin which converts excess glucose to glycogen hence the normal blood glucose levels are maintained within normal ranges (4 mmol/L - 7 mmol/L).

For the 14% of individuals with hypoglycemic results, possible etiological factors are supported by a research that suggested that in patients who don't have diabetes, hypoglycemia is uncommon but when it occurs there are a few major causes such as pharmacological, alcohol intake, counter- regulatory hormone deficiencies and non- islet cell tumours (Koch C.A et al, 2018).

It was found that females had glucose levels less than 6mmol/L while males had glucose levels greater than 6 mmol/L but less than 7mmol/L as shown in figure 2 of the results. In a similar study which was conducted on an Australian population (Sicree et al., 2017). It was reported that women have a lower fasting plasma glucose level which is highly correlated to height and smaller muscle mass, also insulin sensitivity differs by sex compared to men of the same age.

Healthy females have lower skeletal mass and higher adipose tissue mass. Hence all these factors contribute to lower blood glucose levels in females.

9.3. Urinalysis

The urinalysis test showed the absence of glucose, nitrates, blood and urobilinogen in urine for all individuals that participated in the experiment. This being an indicative of normal metabolism and kidney function.

2.4% of the individuals had bilirubin in their urine while 97.6% had no bilirubin in their urine. Unconjugated bilirubin is never present in urine, the glomeruli of the kidney is not able to filter it out and hence its presence is highly suggestive of a glomerular disease or a hepatobiliary disease (Kalakonda et al., 2021).

64.3% of the individuals presented with ketones in their urine and 35.7% had no ketones in urine. Under normal physiological functioning the body uses glucose as the source of energy. In cases of glucose insufficiency due to starvation, the body breaks down the stored fats for energy hence producing ketones, leading to their presence in urine. Other contributing factors include poorly controlled diabetes, diabetic ketoacidosis, anorexia nervosa, bulimia nervosa and alcohol dependency (Dr. Colin tidy et al., 2017). From the presence of ketones in the urine of the majority of the students, it can therefore be said that most of the students do not eat before attending classes, this may lead to starvation and lack of concentration in class.

Specific gravity was abnormal in 63.1% and normal in 36.9% of the individuals in class, slightly equal to the ketones test results. This suggested a wide array of disorders which could have raised the specific gravity such as dehydration, diarrhea, vomiting, congestive heart failure or shock. High levels of certain substances such as glucose, proteins and blood cells may also cause an increase in urine specific gravity.

A small fraction (2%) of the participants were found to have proteins in urine. According to Hall, J.E (2015), in a normal individual proteins must be absent in urine, therefore these findings (proteinuria) indicated glomerular basement abnormalities among various renal disorders such as immunoglobulin A nephropathy and lupus nephritis.

34.1% of the participants in this research presented with abnormal findings in pH value, deviating from the normal (5 - 7). According to essential medical physiology by Sembulingam et al., (2016) pH greater than 7 is suggestive of urinary tract infection by urea-splitting bacteria such as proteus mirabilis, vomiting, gastric suction and respiratory alkalosis. However, pH less than 5 is suggestive of conditions such as diabetes mellitus, emphysema, starvation and the presence of acid-producing bacteria such as E.coli.

Leukocytes in a minimal fraction of individuals that participated in the research were found to be present in urine, this could have indicated urinary tract infections, of which macroscopic examination of the urine displayed a green colour.

9.4. Blood pressure

Blood pressure generally increases with increase in the age of an individual, in the study it was discovered that from the age of 21 to 23 there was a drastic increase in both systolic and diastolic pressure in both males and females, this also agrees with another similar study which was conducted by Liu et al, (2010) who assessed different individuals, and it was discovered that with increase in age an increase in blood pressure tends to occur. Furthermore, individual who were obese were found to have increased blood pressure, this could be because adipose tissue tends to release a variety of substances including adinopectin which could contribute to changes in the sympathetic nervous system and tends to decrease the parasympathetic nervous system.

Concerning sex, the present study demonstrated associations between high systolic and diastolic blood pressure in both sexes.

Regarding practical applications, it should be emphasized that such assessment of blood sugar levels, blood pressure and urine analysis need to be conducted at an earlier age so as to prevent future diseases such as diabetes and cardiovascular diseases.

9.5. Limitations/Challenges

The limitation of this research was the cross-sectional design nature, which does not allow assessment of the possible cause-and-effect relationships. Blood pressure and blood glucose were evaluated on the same day, which would lead to an overestimation of values. Another limiting factor is urine components such as nitrate, urobilinogen, leukocyte require specific tests and not being tested indirectly hence leads to false results. The early screening of these abnormalities in these parameters is key in preventing more life-threatening conditions /disorders such as diabetes, hypertension and obesity

10. Conclusion

Urinalysis, blood glucose, BMI and blood pressure tests remains a colossal public health factor that should not only give concern to the people affected but also the ones likely to get diseases. As mentioned already, treatment will entirely depend on the stage at which disease is caught and a better prognosis is intimately linked with early identification and treatment. The various methods employed to facilitate early detection are only as effective if the message is really out there. Therefore, interventional strategies like public awareness should be initiated, and if already in existence, intensified. These tests needed to be conducted frequently in communities and healthy

facilities. Mostly, tests need to be conducted on every individual at clinical and community level by the Ministry of Health and NGOs as their interventions would have long-term positive ramification in reducing blood pressure disorders, overweight, diabetes and diseases which involves the kidney. Further research can be to ascertain just how huge these problems are and indeed suggest ways of alleviating these problems. In addition, curriculum developers can include sections on health talk to deliberately make people aware of the programs out there, such as screening. Further research can be done in communities to ascertain just how huge these problems are and indeed suggest ways of alleviating these problems.

11. Recommendations

- Enough resources were provided throughout all the days in order to collect more data to draw more informative conclusions.
- The school toilets must be cleaned more regularly to reduce the incidence of abnormal urinalysis results.
- More awareness should be raised concerning the dangers of hypertension and its risk factors.
- Numerous students complained of services provision at school clinic, and how they preferred to go to other clinics for medical attention. The clinic should do more community visits to find out the issues among the community.
- More information to be put out there on the dangers of certain lifestyle such excessive alcohol intake, smoking and diet that are rich in cholesterol that may be contributing to or causing hypertension, and diabetic.
- More information to be put there on the importance of physical exercise that can lead on the losing weights and maintaining BMI.

12. Appendices

Data collection tools

Blood pressure

(1) Blood pressure cuff /sphygmomanometer whose parts include measuring gauge, bladder cuff, valve, bulb, and (2) stethoscope.

Blood sugar

(1) Glucometer, (2) Lancet strip, (3) Testing strip, (4) Cotton wool, (5) Methylated spirit, (6) Sharps box, (7) Hazardous waste bin.

Urine analysis

(1) Reagent strips, (2) Collecting containers, (3) Stopwatch, (4) Urine samples, (5) Color chat, (6) Microscope, (7) Centrifuge, (8) Test tubes, (9) Gloves, (10) Lab coat.

Body mass index (BMI)

(1) Tape measure, (2) Weight scales, (3) Pen, (4) Recording Form.

Declarations

Source of Funding

This study did not receive any grant from funding agencies in the public or not-for-profit sectors.

Competing Interests Statement

The authors have declared no competing interests.

Consent for Publication

The authors declare that they consented to the publication of this study.

Ethical Approval

The ethical considerations were taken into account clearly, according to the principles of autonomy, beneficence, confidentiality, consent, and risks.

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